No. 742,265. PATENTED OCT. 27, 1903.

R. F. WENTZ.

DRIER.

APPLICATION FILED FEB. 14, 1902.

NO MODEL. 2 SHEETS—SHEET 1.

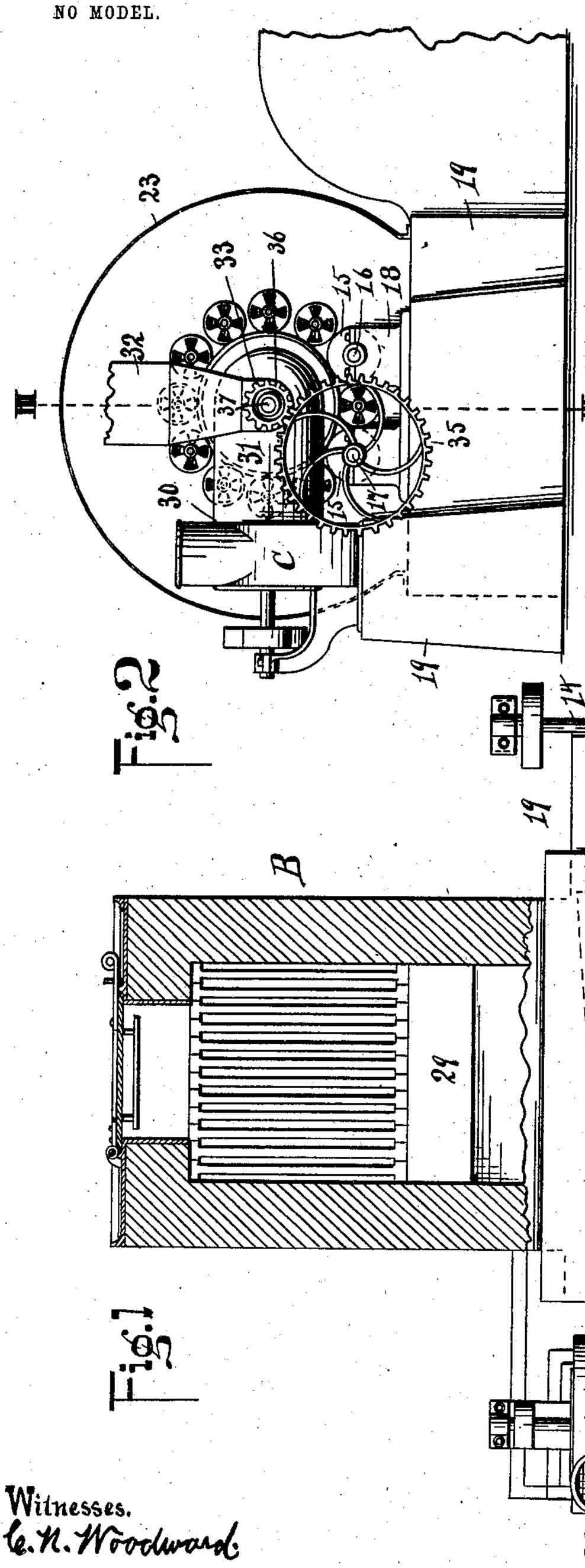

Fig. 2.

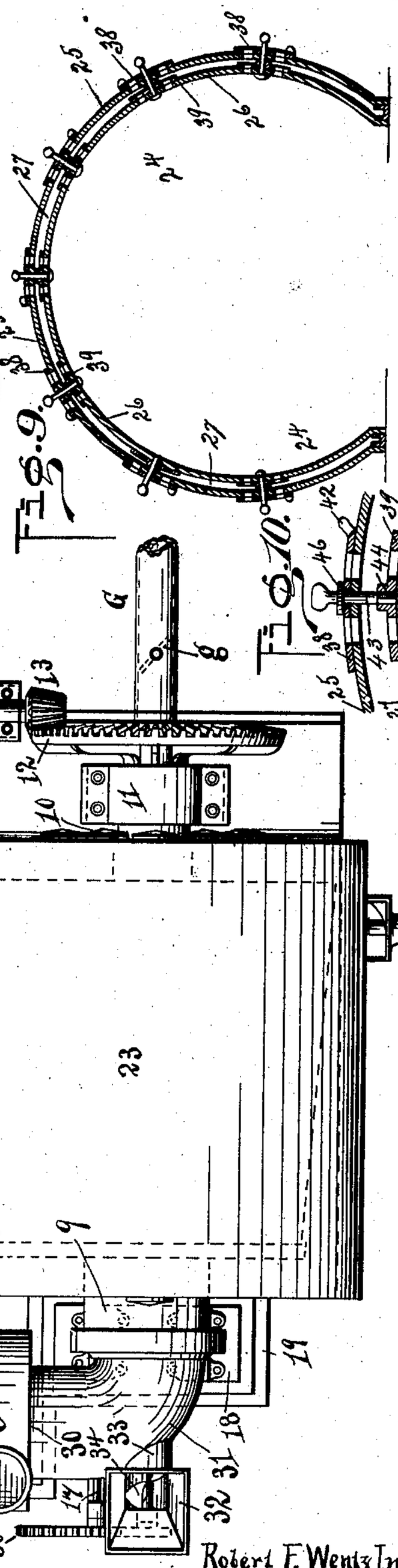

Fig. 9.

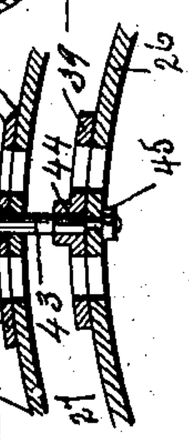

Fig. 10.

Fig. 1.

Witnesses.
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NO MODEL. 2 SHEETS—SHEET 2.

Fig. 1.

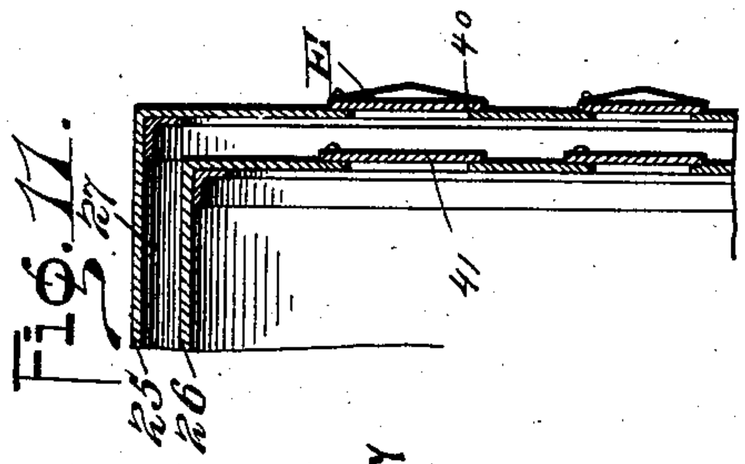


Fig. 4

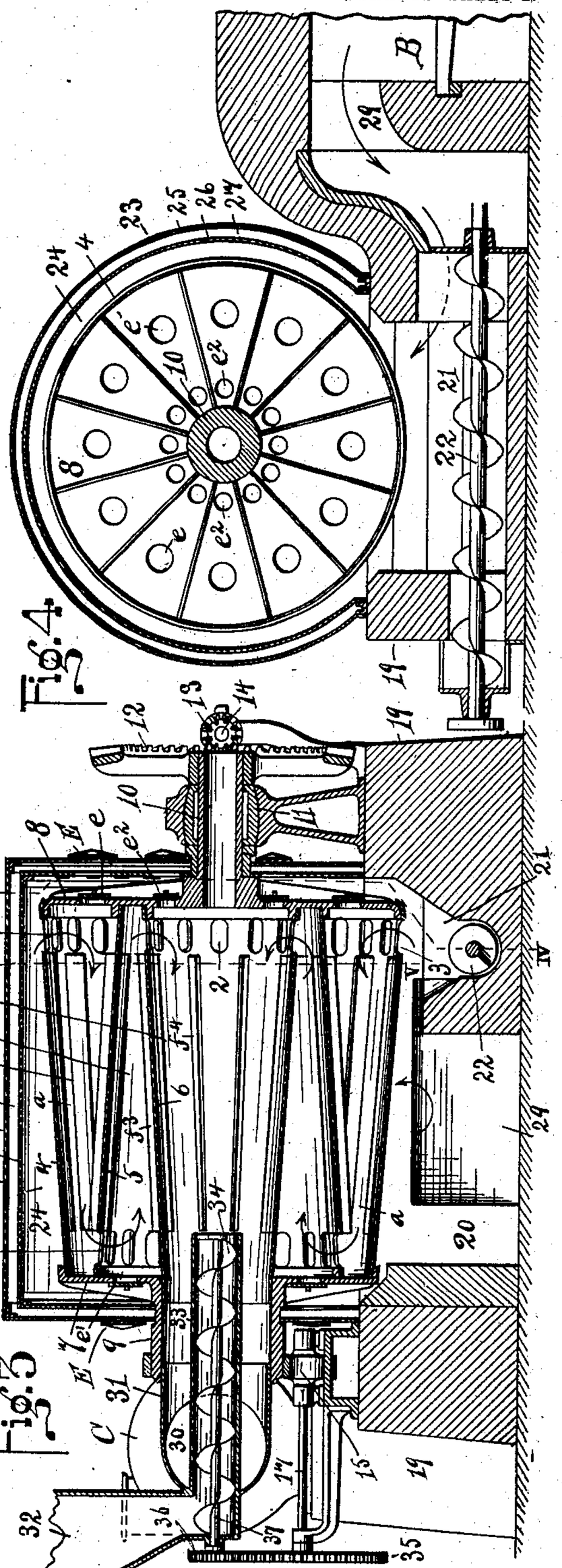


Fig. 7

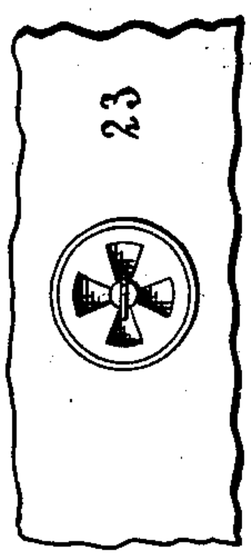


Fig. 8

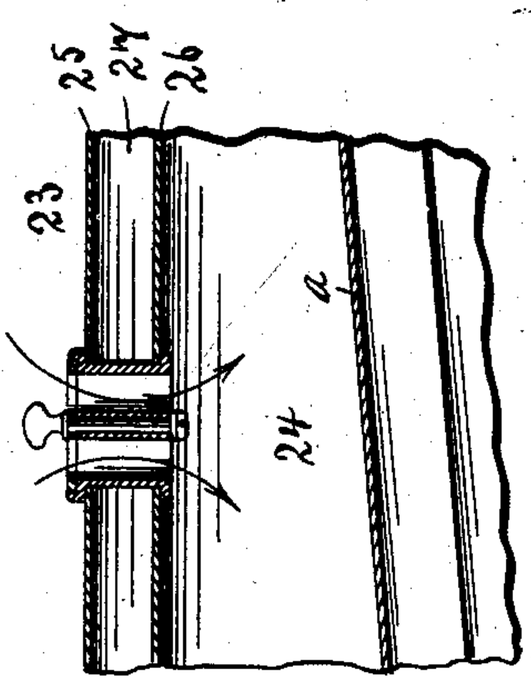


Fig. 5

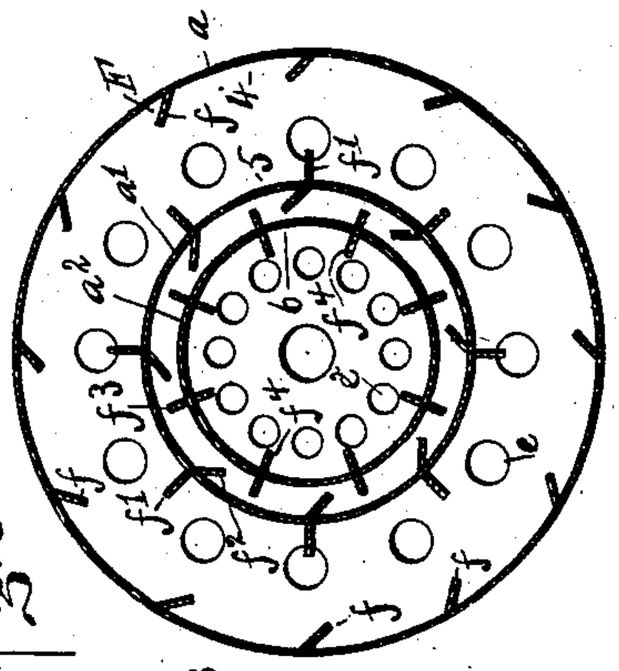
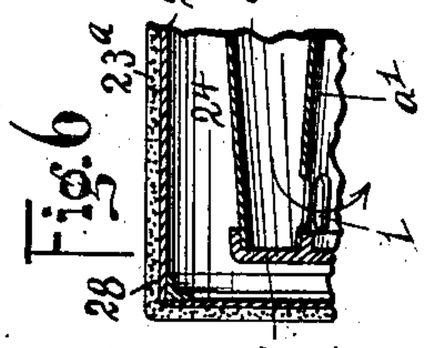


Fig. 6



Witnesses.
C. M. Woodward.
E. R. Alexander

Robert F. Wentz. Inventor,
By A. D. Bliss Attorney.

No. 742,265. Patented October 27, 1903.

UNITED STATES PATENT OFFICE.

ROBERT FILMORE WENTZ, OF NAZARETH, PENNSYLVANIA.

DRIER.

SPECIFICATION forming part of Letters Patent No. 742,265, dated October 27, 1903.

Application filed February 14, 1902. Serial No. 94,107. (No model.)

To all whom it may concern:

Be it known that I, ROBERT FILMORE WENTZ, a citizen of the United States, residing at Nazareth, in the county of Northumberland and State of Pennsylvania, have invented certain new and useful Improvements in Driers, of which the following is a specification, reference being had therein to the accompanying drawings.

My invention relates to driers adapted for use with various descriptions of material of wide range from which moisture is to be extracted.

The objects of the invention are to most efficiently control and regulate the heating and drying fluid, by which I intend products of combustion, gas, or heated air; to regulate and control the velocity of circulation of such fluid through the apparatus; to cause such circulation to be relatively slow at or near the end of the apparatus where the material is most dry and relatively fast at the other end of the apparatus at which the material is entering in its wettest condition; to distribute the material in a thin sheet throughout the entire machine for the purpose of obtaining the best efficiency of action of the drying fluid and balancing the machine; to obtain great capacity of drying in a relatively small space; to economize fuel, the temperature of the operative portion of the drying fluid being closely regulated, so as to avoid any unnecessarily high temperature and waste of heat in the fluid heating means, and to attain other ends hereinafter fully set forth.

With such objects in view the invention consists in the parts and combinations herein pointed out.

In order to make the invention more clearly understood, I have shown in the accompanying drawings means for carrying the invention into practical effect without limiting my improvements in their useful applications to the particular construction which for the purpose of illustration I have delineated.

In said drawings, Figure 1 is a plan view, partly in horizontal section, of the drying apparatus embodying my invention. Fig. 2 is a front end view of the same. Fig. 3 is a longitudinal section on the line III, Fig. 2. Fig. 4 is a transverse section on the line IV, Fig. 3. Fig. 5 is a transverse section of the drying-chamber or series of chambers on line V, Fig. 3. Fig. 6 is a sectional view showing a modification of the non-conducting casing. Figs. 7 and 8 are plan and sectional views illustrating substitute or additional means for admitting air to temper the drying fluid. Figs. 9, 10, and 11 illustrate the preferred arrangement of the dampers.

Referring to the drawings, A indicates a conduit or passage decreasing in area from one end or portion to another end or portion. As best seen in Fig. 3, the embodiment of the invention about to be described shows such passage as of a tortuous character, returning upon itself, one portion of the passage being within another portion, so that the end of greater area is not very remote from the end of smaller area.

In the broader aspects of my invention the particular construction of passage-way shown is not material, although it has important advantages in compactness and efficiency in the drying operation. The conduit A is shown as comprising an outer chamber a of relatively large area, another chamber a' of smaller area, and a third chamber a^2 of still smaller area. These chambers are preferably arranged one within the other and may be concentric about a central axis. They communicate one with another by suitable openings 1 and 2, arranged or situated so as to cause the heating fluid and material to traverse as much as possible of the full length of the passage A. An entrance for the heating fluid is provided by openings 3 at a portion of the passage which is of relatively large area—that is to say, into the chamber a—which openings may also serve for the exit or delivery of the dried material. The said chambers are formed by metallic shells 4, 5, and 6, through which the said communications and openings are cut. These shells are by preference reversely conical in shape and are attached by suitable flanges, bolts, or rivets to heads 7 and 8, the outwardly-extending hollow sleeves, trunnions, or hubs 9 and 10 of which form journals upon which the device may turn as a conical revolving drum. The sleeve at 10 is supported in a bearing 11 and has attached to its outer end a gear-wheel 12, through which the drum may be rotated by a pinion 13 on a power-shaft 14.

The sleeve 9 is carried by antifriction-rollers 15 on shafts 16 17, supported in bearings 18. The supporting parts of the drum rest upon a suitable foundation 19, which is formed, preferably, with an interior chamber or hot-air-supply space 20 and a delivery-chamber 21 for the dried material. This latter chamber may be of hopper form, Fig. 3, and is situated beneath the openings 3 of the drum. From the chamber 21 the dried material is taken away by a conveyer 22 or other suitable means for the purpose.

The passage-way A is surrounded and inclosed by a casing 23, resting on the foundation 19, fitting closely around the drum-supporting extensions and having an interior chamber 24. This casing is by preference non-conducting for the conservation of heat, to that end being constructed with exterior and interior walls 25 and 26, having between them an air-space 27. The casing may, however, be made, as shown in Fig. 6 at 23^a, of a single wall covered with a non-conducting material 28, such as asbestos.

To the passage-way A, constructed as above described, a heating fluid, such as the products of combustion of any suitable fuel, is supplied from a heating means or furnace B, over the bridge-wall 29 of which such products may pass into the space 20 and chamber 24 and thence through the openings 3 into that part of the passage-way which is of the larger or largest area. Thence the heating fluid passes along the chamber a, through the communications 1, back through the chamber a', through the communication 2, and into the chamber a^2, constituting the portion of smaller or smallest area of the passage-way A. This flow of the heating and drying products is induced by an exhausting or draft device. This is conveniently a fan C, the eye 30 of which is connected by a pipe 31 with the drum-sleeve 9, at which sleeve the smaller end of the shell 6 terminates and is suitably attached. It will be understood that a stack might be substituted for the fan C to carry off the heating products and cause the desired flow of the same through the passage-way A.

The material to be dried is caused to pass through the passage-way A in a direction opposite to the flow of the heating products—that is to say, said material has a feeder communicating with the smaller portion of said passage and has its exit from the larger portion of the passage. In Fig. 3 the feeder is indicated at D, comprising a hopper 32, a conveyer-casing 33, extending partly within the drum through the pipe 31 and sleeve 9, and a conveyer 34. By these means the wet or moist material is fed into the smaller part of the chamber a^2, passes thence through the openings 2, the chamber a', the openings 1, and the chamber a, finding its exit through the openings 3 into the chamber 21. In Fig. 3 the arrows show the opposite direction of movement of the heating fluid. I provide for operating the conveyer 34 by a gear-wheel 35 on the roller-shaft 17, which meshes with a pinion 36 on the conveyer-shaft 37. I provide, further, for keeping down the temperature of the heating fluid to the most efficient point for the absorption of moisture relative to the consumption of fuel by admitting air to the passage-way A. The admission of such air immediately affects the combustion-draft in the furnace B and prevents waste of such fuel. This may be accomplished in various ways. I have shown an efficient means for admitting a tempering fluid, such as atmospheric air, to the passage A, consisting of dampers E in the casing 23, by which air may be allowed to flow into the chamber 24, displacing a corresponding amount of heating products from the furnace and decreasing combustion in the latter, as above described. I may further admit such air into the passage-way A at points beyond the openings 3, as through dampers e in the head 8 opening into the chamber a, or through dampers e' opening into the chamber a' through the head 7, or through dampers e^2 opening into the central smaller chamber a^2. I have shown in Figs. 7 and 8 one of the dampers on a larger scale, the same being applied at the top of the casing 23 for the admission of air to the middle portion of the chamber 24.

During the operation above described, the drum being rotated and the heating fluid and material passing through the same in opposite directions, I provide for finely dividing the material, preventing the accumulation of the same by gravity at the bottom of the various parts of the passage A and distributing it evenly in thin sheets throughout the drum by lifting or distributing means F. Said means consists in this illustration of the invention of blades f, f', f^2, f^3, and f^4, arranged and supported upon the inner surface of the shell 4 and upon the outer and inner surfaces of the shells 5 and 6, as best seen in Fig. 5.

In considering the operation of the described apparatus it will be observed that the heating fluid is allowed to travel slowly at the larger part of the passage A on account of the greater area at such part, and such relatively slow movement is desired at that part on account of the material in the same being drier and lighter and apt to be carried away by a strong draft. As the heating fluid proceeds to the smaller parts of the passage A it meets the moisture and heavier material; but here a stronger draft is admissible on account of such heaviness of the material and desirable to carry off more rapidly the excessive moisture. It will further be observed that the circulation and temperature of the heating and drying fluid are under complete and perfect control. For instance, if it should be found that the heating products leaving the apparatus at C have too high a temperature for the economical consumption of fuel outside air can be admitted at the desired point, increasing the absorbing capacity

of the drier and decreasing the consumption of fuel. In case the temperature should be too low, so that the hot air which is loaded with moisture deposits the same before its exit, the supply of atmospheric air independent of the furnace may be decreased or cut off.

I further provide for supplying moisture-absorbing hot air independent of the furnace B to the passage A, as by a pipe G, having a controlling-damper *g* and connected with said passage at a suitable point. In Fig. 1 I have shown said pipe as communicating with the hollow sleeve or trunnion 10. The pipe G will receive hot air from any suitable heater. (Not shown.) By the use in the necessary different degrees of the two absorbing fluid supplies at B and at G, I can obtain great variation of drying action in the apparatus. Thus the material in the first chamber a^2 may require either a low temperature with a large amount of air, a low temperature and a small amount of air, a high temperature and a small amount of air, or a high temperature and a large amount of air. Any of these requirements can be met by manipulation of the various dampers or circulation-controlling means.

The walls of the sheets 4, 5, and 6, forming the alternating passages for the material, act to baffle the latter and prevent its retrogression under the action of the currents of heating fluid.

The use of the drying-drum is not confined to the combination with a furnace, as shown. The heating fluid may be supplied to the chamber 24 from any heater efficient for the purpose.

The dampers for admitting air to the chamber 24 may be arranged as shown in Fig. 9, in which a series of outer dampers 38 are arranged around the casing-wall 25, opening into the space 27, and a corresponding series of dampers 39 in the wall 26, opening into the chamber 24.

Where the dampers E are applied, it will be understood that separate doors 40 41 may be provided for the openings through the outer and inner walls of the casing.

The outer dampers 38 may be operated by the ears 42 and the inner dampers 39 by the central rod 43, which has a suitable engagement at 44 with the hub of the inner damper for that purpose, the said rod passing loosely through the outer damper. The dampers may be held in place by inner and outer nuts or collars 45 and 46 on the rod 43.

What I claim is—

1. In a drier, a series of concentric tapering, cone-like chambers each with its smaller end adjacent to the larger end of each adjacent chamber, a rotary head secured to one end of each cone, an opposite rotary head secured to the other end of each cone, passages for air and material through the wall of each cone at its larger end, means for supplying air at the larger end of the outer cone and exhausting it from the smaller end of the inner cone, and means for feeding the material through the cones in the direction opposite to the air, said parts being constructed and arranged substantially as set forth whereby there is a constantly-narrowing passage-way for the air, and a constantly-widening passage for the material to be dried, substantially as set forth.

2. In a drying apparatus, the combination of the concentrically and alternately oppositely arranged cone-like chambers a a' a^2, the larger end of each communicating with the smaller end of the one outside of and adjacent to it, means for supporting one end of each of the cones with a tight joint for each, means for supporting the opposite end of each of the said cones with an air-tight joint, means for feeding material to be dried to the smaller end of the innermost cone, means for supplying heated air or gases to the larger end of the outermost cone, means for agitating the material as it passes through the cone, and means for rotating the cones, all of said parts being arranged substantially as set forth whereby the heated air or gases travel through a constantly-decreasing passage-way with a correspondingly-increasing velocity, and whereby the material to be dried moves through a constantly-increasing passage-way with a constantly-decreasing velocity, substantially as set forth.

In testimony whereof I affix my signature in presence of two witnesses.

ROBERT FILMORE WENTZ.

Witnesses:

U. LORANGER,

JOE RODGERS.